

PATENT SPECIFICATION

NO DRAWINGS

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COMPLETE SPECIFICATION

Treatment of Rimming Steel

We, RICHARD THOMAS & BALDWIN  
LIMITED, a British Company, of RTB House,  
151, Gower Street, London, W.C.1, do hereby  
declare the invention, for which we pray that  
a patent may be granted to us, and the method  
by which it is to be performed, to be particu-  
larly described in and by the following state-  
ment:—

Rimming steel is economically desirable  
because of the high yield of useful steel that  
can be obtained from each cast. In addition  
it has a better surface finish than aluminium-  
killed steel. It is most commonly converted  
into sheet, which in turn is formed into such  
articles as motor car bodies. In this forming  
process there may be irregular localized yield-  
ing with the result that unsightly surface  
blemishes are produced on the sheet and  
frequently lead to rejection of articles made  
from the sheet. These blemishes are known  
as stretcher-strain markings.

The irregular yielding is caused by a  
reduction in the stress required to produce  
small elongations after the yield point has  
been exceeded. A certain amount of further  
deformation continues to be localized instead  
of spreading. If this yield-point elongation  
can be eliminated the formed sheet will not  
exhibit stretcher-strain markings.

It is possible to counteract the formation  
of the stretcher-strain markings by subjecting  
the sheet to slight plastic deformation while it  
is in the annealed state required for the form-  
ing process. This slight plastic deformation  
is usually effected by temper-rolling or roller  
levelling, and may lead to elongation of the  
sheet by from 0.75 to 5%, and usually by  
about 1 to 1.5%.

Now in practice the final steps applied  
to the steel by the steel maker are the anneal-  
ing and temper-rolling or the equivalent, and  
the sheet is then delivered either to a stock

holder or the ultimate user. In either case  
it may not be formed into the final article for  
some time.

One of the advantageous properties of  
rimming steel is a type of age-hardening,  
called strain-ageing, which slowly hardens the  
steel after it has been deformed by temper-  
rolling or pressing. Unfortunately an effect  
of this strain-ageing is the return of the  
yield-point elongation. As a result, if the  
sheet is not formed within a short time after  
the temper-rolling or the equivalent, stretcher-  
strain markings may appear on it when it is  
formed. The steel maker has of course no  
control over the time at which the sheet  
will in fact be formed.

Our object in this invention is to prolong  
the interval of time between the slight plastic  
deformation and the growth of the yield-point  
elongation to a value at which deleterious  
stretcher-strain markings are produced when  
the sheet is formed. We do this by effecting  
the slight plastic deformation at a temperature  
at least as low as  $-78^{\circ}\text{C}$ , that is to say the  
temperature of dry ice. We prefer to effect  
the deformation at a lower temperature, which  
advantageously is that of liquid nitrogen  
( $-196^{\circ}\text{C}$ ). We find that the return of the  
yield-point elongation during the strain-ageing  
is considerably postponed by means of our  
invention.

The effectiveness of the slight plastic de-  
formation in delaying the return of the yield-  
point elongation increases both as the tempera-  
ture is lowered and as the extent of the de-  
formation is increased. Ideally it should be  
possible for the sheet to be stored for a year,  
and when this is the object the deformation  
should be effected at the temperature of liquid  
nitrogen and amount to 5% elongation. How-  
ever, a lesser period of delay is of great  
practical value and may be obtained either by

usually temper rolled  
while in the annealed state

- 5% elongation at the temperature of dry ice or by 1% elongation at the temperature of liquid nitrogen. The most advantageous combination of elongation and temperature is 1.5% elongation at the temperature of liquid nitrogen. 15
- 5 1.5% elongation at the temperature of liquid nitrogen. 20

WHAT WE CLAIM IS:—

1. A method of counteracting the appearance of stretcher-strain markings on rimming steel by subjecting the steel in the annealed state to slight plastic deformation in which the slight plastic deformation is effected at a temperature at least as low as  $-78^{\circ}\text{C}$ . 15
2. A method of counteracting the appearance of stretcher-strain marking on rimming steel in which the steel in the form of annealed sheet is temper-rolled to give an elongation of at least 1% while it is at the temperature of liquid nitrogen. 20
3. A method according to claim 2 in which the temper-rolling is such as to produce an extension of at least 1.5%.

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